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THz Emission from Mercury Cadmium Telluride Films Grown on Cadmium Zinc Telluride Substrates

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***Abstract*- We have observed THz emission from single- and double-layer HgCdTe (MCT) films epitaxially grown on CdZnTe substrates photoexcited by femtosecond laser pulses. The emitted THz radiation was electro-optically detected in reflection-mode at the 45° specular direction. There is a dramatic variation in the emitted signal level from the double-layer samples, whereas the signal level from the single-layer samples shows a relatively constant variation with composition and/or geometry. For the double-layer samples, the highest peak amplitude recorded is 1/5 of that of an InAs emitter, analogous to double that of a standard ZnTe emitter, and shows promise for further enhancement.**

I. Introduction

It is well known that unbiased semiconductor surfaces photoexcited by near-infrared femtosecond pulses can emit THz radiation (pulses) [1-3]. THz emission is attributed to the buildup of a transient photocurrent due to the surface-field and the differential carrier mobility or/and the buildup of a transient polarization due to the optical rectification effect [1]. Of all the unbiased surface-emitters examined to date, lightly-doped, *p*-type InAs has been found to be the strongest [2,3]. Recently, $Hg_{1-x}Cd_xTe$ (MCT) has come under scrutiny [4], and here we present results of a study using a series of samples with single- and double-layer MCT films with varying composition and thickness, grown on CdZnTe substrates.

II. Results

Fig. 1 shows the emitted peak signal amplitude, where circles represent double-layer samples (1 to 3), squares represent single-layer samples (4 to 6), and the diamond represents the substrate (7). There is a dramatic variation in the peak level for the double-layer samples, whereas it is relatively constant for the single-layer samples.

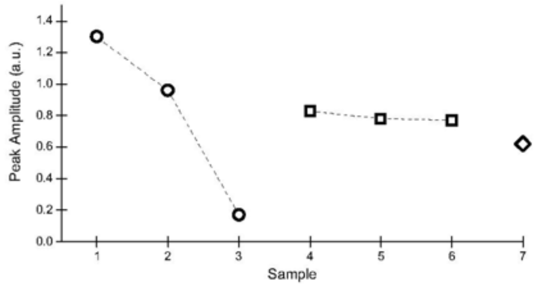

Figure 1. Relative performance.

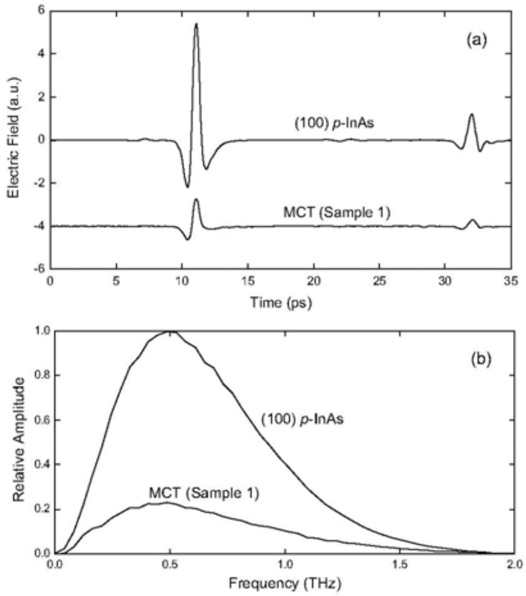

Figure 2. (a) THz signal from MCT sample compared to that from InAs, (b) and their amplitude spectra.

Fig. 2(a) gives the signal from sample 1, compared to that from an optimum InAs emitter. The MCT scan is vertically shifted for clarity. The secondary pulse seen after 21 ps from the main is due to reflections from the detector-crystal. Fig. 2(b) gives the corresponding amplitude spectra obtained by Fourier transforming the isolated pulses. The signal from the MCT sample is 1/5 that of InAs. Further enhancement is expected with different combinations of composition and geometry.

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